IEEE TC 5: High Power Electromagnetics (HPEM) Technical Committee

Minutes of the Phoenix Hybrid Meeting
Wednesday, 7 August 2024 (Noon – 1:30 PM Mountain Standard U.S. Time)

Confirmed Minutes

1) **Opening of the meeting and approval of the agenda – Bill Radasky, Chairman**

Chairman Dr. William (Bill) Radasky brought the meeting to order at Noon, Mountain Standard Time. It is noted that this was a hybrid meeting with 25 individuals attending in person and 4 individuals attending virtually. The Chairman, Bill Radasky, the Vice Chairman, Mike McInerney and the Secretary, Yuichi Hayashi were all present. Radasky welcomed the attendees, reviewed the agenda (see Attachment 1) and asked for suggested changes; none were offered. McInerney made a motion to approve the agenda. Motion Seconded and Carried (MSC).

2) **Review and approval of minutes of previous TC 5 meetings – Bill Radasky, Chairman**

Due to the fact that this year we had two meetings in the past and current year (one in Grand Rapids in 2023 and one in Okinawa in 2024, there are two sets of now confirmed minutes (see Attachments 2A and 2B). It was decided that we would lose significant time reviewing both of the minutes, so it was agreed that all members should check the TC 5 website, and after reviewing both sets of minutes, members should provide any comments/corrections to both minutes to the officers of TC 5 within 30 days (6 September 2024). After that date the minutes will be considered to be confirmed. Since these minutes will not be posted until after 6 September 2024, we have changed the two attachments to indicate that the previous minutes are confirmed, as we received no comments on them.

3) **TC 5 membership list update – All**

The TC 5 current membership list covering the past 5 meetings was reviewed, and for the minutes we will provide the membership list, including this meeting (Attachment 3A). We had 29 attendees at this meeting with 25 in person and 4 virtual. This was the best attendance over the past 4 years. The current membership list was displayed during the meeting with email addresses (but the email addresses will not be included when the minutes are distributed); it was noted that several attendees during the past 2 virtual meetings (2020 and 2021) do not have email addresses identified (and none of these individuals were present this year to update those addresses). Thus it will not be possible

to reach them by email (hopefully they will know to access the TC 5 web page). Only the TC officers' and subcommittee chairs' email addresses are published on the website, and this procedure has been approved by the IEEE EMC Society.

As part of the meeting, one of our new members, Mark Steffka wished to introduce himself to the rest of the group. He presented a slide of his background and experience, and it is included in Attachment 3B.

4) **Report on the paper review process and tutorials – Bill Radasky**

Radasky reviewed the paper review process for both the Okinawa APEMC/Japan EMC Conference and this Phoenix Conference and also the two tutorials that were presented in Phoenix (Attachment 4). In Okinawa in May 2024 there were 43 papers submitted and 41 papers accepted in the HPEM topic area. This was the largest number of submitted papers in memory for the HPEM topic in a regular EMC conference. One of the reasons for the large number was that there were 4 special sessions organized, with 27 papers presented.

For Phoenix there were only 7 HPEM papers submitted (3 regular papers and 4 abstract papers) and only 5 papers were accepted (3 regular papers and 2 abstract papers). The quality of the abstract papers continue to be a concern. This was the smallest number of papers submitted for TC 5 in recent memory. It is possible that the APEMC/Japan EMC Conference drew some of the submissions away from the IEEE EMC Conference this year. It is noted that 2 of the accepted papers were nominated as best student papers, although they did not win an award. Those papers are listed in Attachment 4.

Two tutorials were organized and presented during the Phoenix conference:

- Monday, 5 August 2024, 8:30 AM - Noon
  "Electromagnetic Wave Information Security to Enhance the Reliability of the Information Infrastructure as the Foundation of Society"
  Organizer: Yuichi Hayashi
  Presentations by: Yuichi Hayashi, Chulsoon Hwang, Kengo Iokibe, Shahin Tajik, Youngwoo Kim
- Friday, 9 August 2024, 1:30 - 5:00 PM
  "Progress in IEC SC 77C Standards Regarding HEMP and IEMI Environments, Test Methods and Protection Methods"
  Organizer: William Radasky
  Presentations by: Edl Schamiloglu, William Radasky, Sergio Longoria, Richard Hoad

5) **Report from the Lightning Subcommittee – Marcos Rubinstein and Farhad Rachidi**

A presentation was prepared by Marcos Rubinstein and Farhad Rachidi. The conferences and other lightning events planned and held thus far in 2024 were discussed along with the events planned for 2025. Also 9 WGs in CIGRE Study Committee C4 currently working were identified during the presentation. One WG in IEEE PES was also mentioned. In addition, other lightning activities were summarized including the status of the Santis

Tower data. Radasky thanked the Lightning Subcommittee for providing a comprehensive report.

Further details can be found on this agenda item in Attachment 5.

6) **Report from the EM Information Leakage Subcommittee – Yuichi Hayashi**

Hayashi began his report mentioning the special session that he organized at the APEMC/Japan EMC Conference held in Okinawa from 20-24 May 2024. Both Yuichi Hayashi and Bill Radasky attended the conference, which included a TC 5 meeting, organized by Yuichi Hayashi.

For the Phoenix conference Yuichi reviewed the tutorial that had been presented on Monday focusing on IEMI and EM Information Leakage. Future plans include workshops and special sessions for IEEE EMC 2025 and EMC Europe.

Prof. Hayashi was complemented on his efforts to provide a complete review of activities in the EM Leakage area, worldwide. Further details can be found on this agenda item in Attachment 6.

7) **Report from the HEMP/IEMI Subcommittee – Mike McInerney**

Mike McInerney presented the HEMP/IEMI report in two parts (see Attachment 7). For the HEMP aspects, Bill Radasky provided a summary of HEMP activities including:

- Updates of IEC standards, focusing on commercial versus military approaches to HEMP standardization and the inclusion of new HEMP waveform data.

- Emphasized the importance of differentiating between worst-case scenarios and realistic applications for commercial environments.

- Discussed the need for statistical environments for testing and protection standards.

Radasky recommended that a special session be organized for the IEEE EMC Conference in 2025 dealing with the new understanding of the HEMP E1, E2 and E3 environments and how they should be used for coupling and protection for commercial applications.

With regard to the IEMI aspects, Sven Fisahn mentioned the 2023 IEEE EMC Symposium tutorial presented in Grand Rapids, and the workshop to be held at EMC Europe in 2024 dealing with “Risk Management for Critical Infrastructures”.

8) **Report from ESD Subcommittee – Shubhankar Marathe, Misha Khazhinsky, and John Kinnear**

John Kinnear presented the report from the ESD subcommittee (remotely) which had been prepared by Shubhankar Marathe, Michael Khazhinsky, and John Kinnear (see

Attachment 8). He discussed the paper exchange program between ESDA and the IEEE EMC Society. Also he provided an update of ESD standards mainly from ANSI.

After some discussion it was thought to be worthwhile to hear more details about the standards being developed by ESDA, and it was recommended that a tutorial be organized for the Raleigh 2025 IEEE EMC Conference.

9) **Coordination with SC-1, Smart Grid – Mike McInerney**

McInerney introduced the activities of Special Committee 1 (Smart Grid), which is a coordinating committee, and he indicated that the SC 1 meeting had been held on Monday, with good attendance. It is noted that Mike McInerney is the Chairman of SC 1 and Bill Radasky continues in his role as Vice Chair while Prof. Thomas was not able to continue as Secretary. Leonardo Sandrolini was elected as Secretary last year. McInerney commented that TC 5 is keeping track of any issues involving Smart Grid and HPEM, and both the Chair and the Vice Chair of TC 5 have been attending the SC 1 meetings for many years.

10) **TC 5 web page – Mike McInerney, Vice Chairman**

McInerney is continuing in his role as webmaster for TC 5. He is usually able to quickly update the website, although this year there is a new system and software for updating the web page, and unfortunately the TCs were not notified of this in advance. The TAC promises to try to warn the TCs in the future of changes. The webpage for TC 5 can be found at: https://www.emcs.org/technical-committees/tc-5-high-power-electromagnetics/

11) **Review of HPEM activities since last TC 5 meeting in Grand Rapids – All**

Recent Advancements:

- Insights were shared on recent advancements in high-power electromagnetics (HPEM) and their impact on commercial electronics.
- The discussion emphasized the importance of understanding how HPEM can affect different types of equipment and the need for robust protection measures.

Military and Commercial Overlap:

- Interest was expressed in exploring programs from the Office of Naval Research (ONR) and the Defense Advanced Research Projects Agency (DARPA), which are focusing on HEMP and IEMI effects.
- The overlap between military applications and commercial intentional electromagnetic interference (IEMI) concerns was highlighted, stressing the importance of sharing knowledge and strategies across these fields.

Detection and Protection Strategies:

- There was a discussion on the need for effective detection methods for IEMI threats. It was noted that while HEMP events are typically single-pulse occurrences,

intentional electromagnetic interference (IEMI) can involve continuous pulses causing equipment to reset repeatedly.

- The group discussed the potential for using detection systems to identify and mitigate these threats, especially in critical infrastructure and sensitive environments.

IEMI and Criminal Activity:

- The conversation included examples of IEMI being used for criminal activities, such as manipulating gambling machines to produce fraudulent payouts.
- The importance of understanding these threats and updating standards and practices to counteract them was emphasized.

Participant Contributions:

- Participants were encouraged to share their experiences and knowledge related to HEMP activities, particularly in areas where they have observed or studied significant effects.
- There was a call for continued collaboration and information sharing to enhance the collective understanding of HEMP and develop effective countermeasures.

12) **TC 5 Tutorials/Special Sessions planned for the EMC 2025 in Raleigh – All**

Several proposals were presented and discussed regarding special sessions and tutorials for the 2025 Raleigh conference.

- Tutorial on HPEM Protection: This tutorial will focus on the similarities and differences between HEMP/IEMI countermeasures and lightning protection – Fisahn
- Tutorial on ESDA Standards dealing with ESD: The ESD subcommittee is proposing a tutorial aimed at informing the IEEE community about ESD standards – Kinnear
- Special Session on Information Leakage: This subcommittee has previously proposed a special session at the last IEEE conference and is likely to propose a similar session this time – Hayashi
- Special Session on the Theory and Applications of HEMP: This special session follows much of the new work in updating IEC 61000-2-9 – Radasky

The TC 5 Chair will follow up with the identified volunteers when the time arrives for submitting official proposals for tutorials and/or special sessions.

13) **Discussion of standardization activities – Fred Heather**

After many years of discussion concerning the need for a new IEEE standard dealing with the effects on electronics when an aircraft is struck by lightning, a new PAR 2838 has been approved and work is ongoing. It is titled, “Aircraft Component Lightning Strike Direct Effects Qualification.”

Progress and Challenges:

- Fred Heather discussed the progress on the IEC 2838 standard, highlighting the ongoing efforts and challenges.
- A recent meeting with the Society of Automotive Engineers (SAE) revealed that they did not see value in the standard from their perspective, primarily due to economic reasons.
- Despite this, it was confirmed that the development of the standard will continue, with a meeting scheduled for Thursday at 9:30 AM to address the integration of independent test methods. The agenda for that meeting is in Attachment 13.

Development of Test Methods:

- Fourteen different test methods have been identified for testing various components in aircraft and space vehicles.
- Expertise from those experienced in conducting these tests is needed to independently establish the techniques to be used for testing these components.

Standardization Approach:

- The test methods are planned to be conducted in a standardized manner similar to general electromagnetic compatibility (EMC) testing.
- The main objective is to ensure that all equipment is tested using a consistent method, resulting in reliable, repeatable outcomes.
- To maintain the independence of IEC standards and to meet industry user needs, collaboration with IEEE experts will be sought.

14) **Election Status of TC 5 Officers – Bill Radasky**

The current officers of TC 5 are serving 3-year terms that ends on 31 December 2025. Elections will be held at the TC 5 meeting in Raleigh.

15) **Any other business - All**

No other business was raised.

16) **Adjournment – All**

The meeting was adjourned at 1:30 PM.

Attachments (labeled with agenda item and found on the TC 5 Website)

1-Meeting Agenda
2-Confirmed Okinawa and Phoenix Minutes
3-TC 5 Membership Update (including 2024 meeting attendees)
4-Report on Paper Review Process in Okinawa and Phoenix

5-Lightning Subcommittee Report
6-EM Information Leakage Subcommittee Report
7-HEMP/IEMI Subcommittee Report
8-ESD Subcommittee Report
13-IEEE P2838 Standard Meeting Agenda